AMENDMENTS TO THE SPECIFICATION

Please replace the present title with the following amended title:

PNEUMATIC TIRE AND METHOD OF ~~MOUNTING THE~~ INSTALLING SAME

Please amend the specification as follows:

[0002] When a tire is continuously used under a runflat condition which is caused by a low tire pressure or a puncture, deflection and deformation of a sidewall portion of the tire become larger than those under an ordinal design pressure condition and thus tire failure often occurs at an early stage. Observing failure state of a general tire, the large deformation of the sidewall portion is likely to cause repeated contacts between portions on the interior surface of the tire, resulting in wear and cut of the tire, or it is likely to disengage the tire from the rim in conjunction with large collapse deformation of a bead portion.

[0005] Means for ~~inhibit~~ inhibiting an occurrence of the nucleus of the failure have been suggested in which rubbers are laminated between a plurality of carcass plies or a reinforcing rubber having a specific shape is placed on the interior surface of the carcass (see, for example, JP 2000-168319 A, JP 2000-52724 A and JP 2000-190715 A). All of these means, however, ~~involves~~ involve an increased weight or a deterioration of production efficiency. In addition, rigidity in the tire's radial direction, i.e. a so-called longitudinal spring rate during an ordinal driving under a normal internal pressure condition is increased, so that the riding comfort is prone to be diminished. As such, it is difficult to effectively improve the runflat durability.

[0012] The tire disclosed in JP 11-157311 A is directed to an enhancement of the driving characteristics in a runflat state as well as an improvement of the durability of the bead portion. In this tire, a rim-slippage preventing layer consisting of a relatively soft rubber is provided at a position where the upper part of the rim flange of the rim guard portion stand opposite to each other, and the rest of the [[rum]] rim guard portion consists of hard rubber. However, the rubber constituting the rim guard portion of this tire is not specified in relation to the outer skin rubber constituting the sidewall portion. Although such a configuration may contribute to some effects of improvement to the runflat durability, it cannot provide sufficient runflat durability under a more severe runflat condition such as involving a side force.

[0013] The tire disclosed in JP 53-138106 A is intended to keep a sufficient withstand load and durability during runflat running without there happening such an accident as the rim slippage. In this tire, a high-rigidity reinforcement member (pseudo-bead) having a circular shape is embedded in the rim guard portion. However, the pseudo-bead is provided not for inhibiting the deflection of the sidewall portion. In addition, the tire has a problem in which the rubber portion of the bead portion, which is sandwiched between the rim flange and the pseudo-bead during runflat running, is prone to ~~repeatedly and largely deforms~~ repeated and large deformations to become a nucleus of the failure. Moreover, the longitudinal spring rate at the ordinal internal pressure is increased and thus the riding comfort tends to ~~be deteriorated~~ deteriorate.

[0018] The second aspect of the present invention has the same fundamental constitution as the first aspect, and is characterized in that at least one composite reinforcing layer consisting of [[a]] rubber containing reinforcing elements is arranged at a position adjacent to at least a part of a circumferential surface of the rim guard portion.

[0019] The third aspect of the present invention has the same fundamental constitution as the first aspect, and is characterized in that at least a part of the rim guard portion is formed by a hard rubber, a 100% modulus of the hard rubber is not less than 3.0 MPa and within a range from two to five times as much as that of [[a]] an outer skin rubber constituting the sidewall portions, and at least one composite reinforcing layer consisting of [[a]] rubber containing reinforcing elements is arranged within the rim guard portion or at a position adjacent to at least a part of a circumferential surface of the [[rum]] rim guard portion.

[0020] The rim guard portion of the third aspect preferably has an inner ~~rubbers~~ rubber section located in the inner side in the tire's width direction and consisting of a hard rubber, and an outer rubber section located in the outer side in the tire's width direction and consisting of a soft rubber.

[0023] In the first, second and third aspects, it is preferred that a pair of narrow reinforcing belts in which cords ~~extends~~ extend in parallel to the tire's circumferential direction are provided at positions each covering an end of the belt, and that a distance measured from a tread width end

position to the inner end position of the narrow reinforcing belt along the tire's width direction is not less than 1/4 of the tread width. In addition, when a plurality of circumferential main ~~groove~~ grooves extending along the tire's circumferential direction are provided on the tread portion, the narrow reinforcing belt is preferably so disposed that its inner end in the tire's width direction is laid inside from the width center line of the outermost circumferential main groove in the tire's width direction.

[0025] As used herein, the terms "regulated rim" and "given air pressure" refer to a standard rim and [[a]] an air pressure corresponding to the maximum load capability (maximum air pressure), respectively, specified in JATMA (Japan Automobile Tire Manufacturers Association) YEAR BOOK (2002).

[0028] The rim guard portion preferably has a generally trapezoidal or a generally ~~triangle~~ triangular sectional shape. In the former case, it is more preferred that the top plane of the rim guard portion forms a flat surface and/or the length of the top plane of the rim guard portion in the cross section taken along the tire's width direction is 0.14-0.90 times as much as the above-mentioned length of the bottom.

[0034] Between a crown portion of the carcass 6 and the tread portion 5, there is provided a belt 8 consisting of at least one cord layer, and two cord layers 8a, 8b in FIG. 1. Further, a reinforcing rubber 11 having a generally crescent sectional shape is provided at least on an

interior surface side of sidewall portion 4, and between an interior surface 7a of the carcass and an inner liner 10 across the bead portion 3 and ~~immediate~~ immediately underneath of an end portion of the belt 8 in FIG. 1. In this way, the tire has a configuration of a so-called reinforced sidewall type runflat tire.

[0036] Moreover, a ring-shaped rim guard portion 13 projecting outwardly in the tire's width direction is arranged at the exterior surface position [[of the]] immediately above a rim flange Rf in a state where the tire is applied on a standard rim R.

[0037] A constitutional feature of the present invention is to optimize the rim guard portion 13 which is provided on an exterior surface 4a of the sidewall portion 4 of the tire 1 for the purpose of preventing the tire 1 and/or rim R from being damaged due to a contact with obstacles such as curbstones. More specifically, in the first aspect, the rim guard portion 13 is formed by a hard rubber, and a 100% modulus of the hard rubber is not less than 3.0 MPa and within a range from two to five times as much as that of an outer skin rubber 14 constituting the sidewall portion 4. In the second aspect, at least one composite reinforcing layer 16 consisting of a rubber containing reinforcing elements is arranged at a position adjacent to at least a part of a circumferential surface 15 of the rim guard ~~potion~~ portion 13. In the third aspect, at least a part of the rim guard portion 13 is formed by a hard rubber, a 100% modulus of the hard rubber is not less than 3.0 MPa and within a range from two to five times as much as that of [[a]] an outer skin rubber constituting the sidewall portions 4, and at least one composite reinforcing layer 16

consisting of a rubber containing reinforcing elements is arranged within the rim guard portion 13 or at a position adjacent to at least a part of a circumferential surface of the [[rum]] rim guard portion 13.

[0043] Considering the deformation of the tire, a tread surface contacting the ground and a rim-engaging portion are presumed as fixed portions. The present inventors, however, further studied to suppress the deformation at the maximum width position of the tire and found that it is more effective to indirectly suppress the deformation at the maximum width position by enhancing the stiffness of the fixed portions which are roots of the deformation rather than to directly increase the gauge thickness at the maximum width position to enhance the stiffness. In this case, the neighborhood of the fixed portions is the buttress portion neighboring the tread portion and the bead portion. The present inventors reached an idea that enhancing the stiffness of the neighborhood of the bead portion, among others, fitting on the rim having remarkably higher stiffness than the tire can [[be]] effectively suppress the deformation at the maximum width direction. In addition, increasing the gauge thickness at the buttress portion and especially the maximum width portion results in a larger stiffness and inertial mass, which may deteriorate the riding comfort. On the contrary, increasing the gauge thickness is considered to involve these adverse effects.

[0044] The present inventors investigated means for effectively ~~enhance~~ enhancing the stiffness at the root (neighborhood) of the bead portion as the fixed portion, and found that

optimizing the rim guard portion 13, which is referred to as a rim guard and is provided on the exterior surface of the sidewall portion of the tire for the purpose of preventing the tire and rim from being damaged by contacts with obstacles such as curbstones, may remarkably increase a bending stiffness of the bead portion 3, so that the deflection and deformation of the sidewall portion 4 during the runflat running are effectively suppressed to hardly cause the failure of the tire.

[0048] Using these relational expressions and judging magnitude relation between the deformations in the case where the projection (rim guard portion) is provided on the entire beam as shown in FIG. 3 and in the case where it is provided on a part of the beam as shown in FIG. 4 while keeping the volume [[at]] the same, the following relation is obtained;

$$g(t, h, k) = (1/k^2) \{I_0I_2 + 2(k-1) + I_1I_2(k-1)^2 - I_0I_1k^2\}$$

The present inventors further conducted numerical analysis with substituting $j=h/t$ and ~~nondimesionalizing~~ non-dimensionalizing the thickness, and found that the deflection and deformation could be suppressed more by the narrow and thick rim guard portion 13B as shown in FIG. 4 than by the wide and thin rim guard portion 13A as shown in FIG. 3.

[0050] As a result, the runflat durability while continuously running under a runflat condition due to a low tire pressure or a puncture can be successfully and effectively improved without sacrificing other characteristics especially such as riding comfort during an ordinal driving at normal internal pressure by, according to the first aspect, forming the rim guard portion 13 by a

hard rubber and making a 100% modulus of the hard rubber not less than 3.0 MPa and within a range from two to five times as much as that of an outer skin rubber 14 constituting the sidewall portion 4, or by, according to the second aspect, arranging at least one composite reinforcing layer 16 consisting of a rubber containing reinforcing elements at a position adjacent to at least a part of a circumferential surface 15 of the rim guard ~~potion~~ portion 13, or by, according to the third aspect, forming the rim guard portion 13 by a hard rubber, making a 100% modulus of the hard rubber not less than 3.0 MPa and within a range from two to five times as much as that of [[a]] an outer skin rubber constituting the sidewall portions 4, and arranging at least one composite reinforcing layer 16 consisting of a rubber containing reinforcing elements within the rim guard portion 13 or at a position adjacent to at least a part of a circumferential surface of the [[rum]] rim guard portion 13.

[0052] The above-mentioned constitution of the first aspect alone is, however, not sufficient in terms of the durability. Therefore, in order to minimize risks such as a separation due to rubber properties of the outer skin rubber constituting the sidewall portion and the rubber constituting the rim guard portion while sufficiently [[exert]] exerting the effect of the present invention, it is necessary to make the 100% modulus of the hard rubber constituting the rim guard portion two to five times as much as the 100% modulus of the outer skin rubber constituting the sidewall portion in the first aspect. That is, a balance of the riding comfort at the ordinal internal pressure and the runflat durability can be optimized by limiting the 100%

modulus of the hard rubber constituting the rim guard portion within two to five times as much as that of the outer skin rubber constituting the sidewall portion.

[0059] If the sectional shape of the inner rubber section 31 is a complicated shape such as a generally similar shape as the sectional shape of the rim guard portion 13 as shown in FIG. 6, the reinforcing elements constituting the composite reinforcing layer 16 [[is]] are preferably non-woven fabric. When the reinforcing elements constituting the composite reinforcing layer 16 are formed by nonwoven fabric, the composite reinforcing layer 16 can easily change its shape to adapt to the irregular sectional shape and thus its arrangement becomes easier. As the nonwoven fabric, aramid, polyethylene terephthalate (PET), polyethylene naphthalate (PEN) and the like may be employed.

[0060] FIG. 7 shows a principal part of another pneumatic tire according to the third aspect of the present invention depicted in a state where the tire is mounted on a rim. As shown in FIG. 7, when the sectional shape of the inner rubber section 31 is simple, the reinforcing elements constituting the composite reinforcing layer 16 [[is]] are preferably steel or organic cords. When the sectional shape of the inner rubber portion 31 has few concavities and convexities, even the composite reinforcing layer using the steel or organic cords may be easily arranged and besides an effect of suppressing a volumetric deformation of the inner rubber section 31 is larger than that of the nonwoven fabric.

[0061] Although FIGS. 6 and 7 show embodiments in which the composite reinforcing layer 16 ~~extending~~ extends in the sidewall portion 4, the composite reinforcing layer 16 may only be embedded in the position adjacent to at least a portion of the exterior surface of the inner rubber section 31 and does not necessarily extend in the sidewall portion 4.

[0062] The reinforcing elements constituting the composite reinforcing layer 16 may be aligned along a specific direction similar to cords in a rubber coated cord layer. However, the nonwoven fabric without an anisotropy is ~~preferable~~ preferably used to effectively enhance the bending and torsion stiffness in terms of the material science. In addition, the reinforcing elements constituting the composite reinforcing layer 16 [[is]] are preferably a filament fiber having a fiber diameter of 0.01-1 mm and a fiber length of not less than 1 mm, such as an aramid fiber or a polyethylene terephthalate (PET) fiber, and more preferably an aramid fiber having a high stiffness.

[0064] As used herein, disposing the composite reinforcing layer to wrap around the exterior surface 15a of the rim guard portion 13 specifically means that the disposed position of the reinforcing elements of the composite reinforcing layer ~~locates~~ is located in the exterior surface side from the position corresponding to 70% of the rim guard height hmax and between the position of the exterior circumferential surface 15a and the position within 3 mm therefrom and in the rim guard portion. The composite reinforcing layer 16 itself may be provided on the

exterior circumferential surface 15a of the rim guard portion 13 or may be embedded in the rim guard portion 13.

[0065] When the composite reinforcing layer 16 is desired to prevent damage due to a contact between the exterior surface of a bead and a rim, the layer may extend across the circumferential surface 15 [[o]] of the rim guard portion 13 and the exterior surface of the bead portion contacting the rim R, as shown in FIGS. 11-13. Further, in the case where the composite reinforcing layer 16 is disposed on the exterior surface 15a of the rim guard portion 13 and where a surface appearance, weather resistance and the like of the tire need to be improved, a rubber layer 21 may be provided to cover the composite reinforcing layer, as shown in FIG. 14.

[0066] From the view point of improving a high-speed durability and the like, at least one wide reinforcing belt 22 covering the entire exterior surface of the belt 8 may be provided and at least a pair of narrow reinforcing belts, two pairs of narrow reinforcing belts 23a, 23b in FIG. 5 in which cords extending in parallel to the tire's circumferential direction may be arranged at the positions covering either end ~~portions~~ portion of the belt 8. In this case, for at least one pair of narrow reinforcing [[belt]] belts 23b of the narrow reinforcing belts 23a, 23b, a distance X measured from the tread end position 25 to the inner end position 24 of the [[belt]] belts 23b along the tire's width direction [[is]] are preferably not less than 1/4 of the tread width W, from the view point of reducing the strain of the reinforcing rubber 11. That is, in the conventional runflat tire, a buckling (lifting deformation) tends to occur in the tread portion neighboring the

buttress portion near the reinforcing rubber during the runflat running as shown in FIG. 15. Such a buckling can be prevented by setting the distance X measured from the tread end position 25 to the inner end position 24 of the [[belt]] belts 23b along the tire's width direction to not less than 1/4 of the tread width W, thereby further improving the runflat durability.

[0068] It is generally thought that a uniform gauge distribution without any significant difference from the buttress portion to the bead portion is [[a]] desirable in terms of the basic configuration of a tire. The present inventors, however, found that when more rubber is applied to the tire having generally uniform gauge distribution to improve the durability, the durability can be effectively improved not by uniformly increasing the entire gauge thickness without any particular reason, but by intensively increasing the gauge thickness of the principal part. As a result, the present inventors also found that the deflection and deformation of the side portion of the tire can be suppressed to effectively improve the durability when the ring-shaped rim guard portion 13 projecting outwardly in the tire's width direction is so provided within a specific area 20 on the exterior surface 4a of the tire extending from the tire's maximum width position 17 on the exterior surface 4a to the highest position 19 of the exterior surface which contacts the exterior surface 18 of the rim flange that its maximum height hmax has a given proportion to the tire thickness t. That is, on condition that the tire thickness t within the above-mentioned specific area 20 is as uniform as possible, and more specifically that when an arc is drawn to circumscribe both the tire's maximum width position 17 and the exterior surface 18 of the rim flange and the arc is assumed as a reference arc C approximating the contour of the exterior surface 4a

of the specific area 20 (excluding the rim guard portion 13), a ratio of the minimum value to the maximum value of the tire thickness t, which [[are]] is measured on a plurality of normal lines perpendicular to the reference arc C within the specific area 20 ranges from 0.8 to 1.0, and the maximum height hmax of the rim guard portion, which is the distance between the reference arc C and the top face 28 of the rim guard portion 13 measured along on the normal line m drawn from the reference arc, is preferably 0.52-1.40 times as much as the tire thickness measured on the same normal condition. With these configurations, the deflection and deformation of the side portion of the tire can be suppressed to further improve the durability. When the maximum height hmax of the rim guard portion 13 is less than 0.52 times of the tire thickness t, the effect of improving the durability is small. On the other hand, when it exceeds 1.40 times of the tire thickness t, the deflection and deformation remain the same but the durability may be reduced.

[0071] In the present invention, it is important to optimize the height (thickness) distribution of the rim guard portion 13. In order that the arrangement of the rim guard portion directly contributes to the increase of the bending stiffness, it is desirable that thin-wall portions at which the height of the rim guard portion 13 is low are present as little as possible. To this end, the average height ha of the rim guard portion 13 is preferably not less than 0.6 times of the maximum height hmax of the rim guard portion 13. Further, the average height ha of the rim guard portion 13 is preferably less than 1.0 time of the maximum height hmax of the rim guard portion 13, since more effects of increasing the stiffness can be exerted when the length B of the bottom 29 is longer than the length T of the top face 28 of the rim guard portion 13.

[0072] The rim guard portion 13 preferably has a generally trapezoidal sectional shape (FIG. 17) or a generally triangle sectional shape (FIG. 1). When the rim guard portion 13 has a generally trapezoidal sectional shape, the top face 28 of the rim guard portion 13 is preferably shaped in flat and the length T of the top face of the rim guard ~~potion~~ portion 13 in a section in the tire's width direction is more preferably within a range of 0.14-0.90 times as much as the length B of the bottom. If it is less than 0.14 times, the upper side of the trapezoid is small and thus the effect of the beam becomes smaller. If, on the other hand, it exceeds 0.90 times, the outer skin line extending between the side portion and the rim guard portion does not form a straight line, so that there is a risk of causing cracks.

[0073] A boundary portion 30 between the exterior surface 4a and the exterior circumferential surface 15a of the rim guard portion 13 is preferably formed as a smooth curve, since stress tends to concentrate thereon.

[0082] As appreciated from the results shown in Table 1, all of the Examples [[has]] have a superior total balanced performance of runflat durability, riding comfort during an ordinal running and tire weight. In addition, the tires of Examples 1-4 and 9-11 maintain good appearances of the rim guard portions.

Please amend the Abstract of the Disclosure as follows:

The present invention ~~is to provide~~ provides a runflat tire having an effectively improved runflat durability while continuously running under a runflat condition due to a low tire pressure or puncture, without sacrificing other characteristics such as riding comfort during an ordinal driving at normal internal pressure. A runflat tire 1 according to the first aspect comprises a belt 8 consisting of at least one rubber-coated cord layer laid between a crown portion of a carcass 7 and a tread portion 5, the carcass consisting of at least one ply toroidally extending bead portions 3, sidewall portions 4 and the tread portion; a reinforcing rubber 11 which has a generally crescent sectional shape and is arranged at the interior surface side at least of sidewall portions 4; and a ring-shaped rim guard portion 13 protruding outwardly in the tire's width direction arranged at the exterior surface position of the tire immediately above a rim flange Rf. The tire is characterized in that the rim guard portion 13 is formed by a hard rubber, and a 100% modulus of the hard rubber is not less than 3.0 MPa and within a range from two to five times as much as that of an outer skin rubber 14 constituting the sidewall portions 4.